

Stage 1 Disinfectant/Disinfection By-Products Rule

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Overview

Stage 1 General Requirements

- Monitoring Plans
- Lowers MCL for Trihalomethanes (0.080 mg/L)
- New MCL for Haloacetic acids (0.060 mg/L)
- Other new contaminants/MCLs (chlorite, bromate)
- Maximum residual disinfectant levels
- D/DBP precursor (organic carbon) removal

Stage 1 Applicability

- **All** community and non-transient non-community systems
 - Surface and GWUDI systems >10,000 compliance by January 1, 2002
 - Surface and GWUDI systems <10,000 compliance by January 1, 2004
 - Ground water systems compliance by January 1, 2004
- Transient non-community >10,000 only if use chlorine dioxide

Monitoring Plans

- Must submit a DBP monitoring plan
 - New distribution sites based on “total” population served
 - Includes consecutive systems regardless if they booster chlorinate
 - Surface waters >10K
 - 4 sites/Q with 3 average sites and 1 maximum
 - Ground waters >10K and surface waters <10K
 - 1 site/Q at maximum
 - Ground waters <10K and surface waters <500
 - 1 site per year at maximum site in month with warmest temperature

Monitoring Plans (continued)

- Monitoring Plan continued
 - Must also have raw water and combined filter effluent sites for TOC sampling
 - If use chlorine dioxide, 3 distribution sites for compliance sampling
- Submittal (minimum)
 - New sites listed on sample site form
 - Map showing locations of sites and water plant
- Plan is reviewed, revised if necessary then approved
 - New sites entered into compliance database

THMs and HAAs

- Maximum contaminant levels
 - THMs 0.080 mg/L
 - HAAs 0.060 mg/L
 - Based on a distribution 4 quarter annual running average
- Things to note
 - Lower THM MCL
 - Labs not as experienced with HAA analysis as with THMs
 - MCL figure is to 3 places past the decimal place
 - 0.XXX
- No change in how compliance is calculated

Chlorine Dioxide

- Maximum contaminant level
 - Chlorite 1.0 mg/L
- Compliance
 - Chlorite
 - Must monitor plant tap daily with distribution follow-up sampling if exceed MCL
 - Compliance based on monthly average of the 3 distribution system samples
- Approximately 9 systems in state on chlorine dioxide

Ozone

- Maximum contaminant level
 - Bromate 0.010 mg/L
 - Monitored at the plant tap
 - For reduced monitoring must also do raw water bromide and results must be less than 0.05 mg/L
- No system except for bottled water facilities using ozone

Maximum Residual Disinfectant Levels (MRDL)

- Used to be worried with not having enough chlorine residual in the distribution system
- Now have maximum limits
 - Chlorine 4.0 mg/L
 - Chloramines 4.0 mg/L
 - Chlorine dioxide 0.8 mg/L
- Monitored in the distribution system at the same time as total coliforms are collected

Precursor Removal

(Fancy Term for TOC Removal)

- Treatment Technique
 - Total organic carbon (TOC) removal
 - Theory is that if removal the organics that combine with chlorine to make DBPs then less DBPs will be made
 - Percent required removal dependent upon raw water alkalinity and TOC level
- Comparison of TOC removal between the raw water and combined filter effluent values and the “required” removal

General Issues

- Turn-around time on test results
 - Need to do sampling earlier enough in the monitoring period (month, quarter) to resample if necessary
 - Request labs for quicker turn-around time
 - This may cost
- Recordkeeping
 - Water system should do own recordkeeping and tracking

The image features a spiral-bound notebook with a brown cover and a cream-colored page. The spiral binding is on the left side. The text "THMs and HAAs" is centered on the page in a dark brown, serif font.

THMs and HAAs

Stage 1 Requirements

- Maximum Contaminant Levels
 - THMs now 0.080 mg/L (was 0.10 mg/L)
 - HAAs now 0.060 mg/L
- Again, note the change in the digits to the right of the decimal

Compliance Calculations

- Distribution sampling according to the submitted monitoring plan
- **NO LONGER** need to do a raw sample
 - **DO** a plant tap instead
 - This will tell you if you are making DBPs in the plant or in the distribution system and will help focus control

Compliance Calculations (continued)

- >10,000 Surface systems
 - Minimum of 4 sites sampled quarterly
 - 3 average residence time sites
 - 1 representative of maximum residence time
 - Hydraulic not driving time or as the crow flies
 - Distribution 4 quarter annual running average
 - What does this mean?
 - 1st average the 4 samples site results for the quarter
 - Add that average to the last 3 quarters averages
 - Divide by 4

Compliance Calculations (continued)

- EXAMPLE

- 1st Q 2004

- Site 1 0.032 mg/L
 - Site 2 0.030 mg/L
 - Site 3 0.028 mg/L
 - Site 4 0.045 mg/L
 - **Average** of the 4 sites 0.034 mg/L
- Total 0.135 mg/L

- 4Q running annual average

- 2nd Q 2003 0.045 mg/L
 - 3rd Q 2003 0.065 mg/L
 - 4th Q 2003 0.045 mg/L
 - 1st Q 2004 0.034 mg/L
 - 4Q running annual **average** 0.047 mg/L
- Total 0.189 mg/L

Compliance Calculations (continued)

- For $>10,000$ Ground water systems and $<10,000$ surface water systems
 - Minimum of 1 site sampled quarterly
 - Representative of maximum residence time
 - Compliance calculated as shown previously
 - In this case don't average quarterly results because only 1 sample taken
 - Average last 4 quarters individual site result to get 4 Q running annual average

Compliance Calculations (continued)

- For <500 surface water and $>10,000$ groundwater systems
 - Minimum of 1 site sampled annually
 - Representative of maximum hydraulic residence time
 - Taken in the warmest month of the year
 - Compliance is based on the average of the samples taken for the year
 - Only 1 sample so that is the average
 - This could be a **big** issue with very small surface water systems

Compliance Calculations (continued)

- If a water systems decides to take additional samples or sample sets
 - All results are averaged
 - Example, if 2 sets of THMs and HAAs are sent in for the 1st Q of 2004, all results are averaged together

Analytical Methods

- THMs and HAAs
 - Both EPA and Standard Method test methods
 - Holding times vary with method so check with your lab or Compliance Officer
 - Labs must be certified by KY

Analytical Methods (continued)

– Issues

- HAA procedure has multiple steps, including an extraction process
- Labs not as familiar with HAA method as the THM one (25+ years doing THMs)
- Make sure your lab is carrying out to the correct number of places past the decimal point
- Don't be afraid to split sample, question your lab and ask for QA/QC data

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THM/HAA Form

A spiral-bound notebook with a brown cover and a white page. The spiral binding is on the left side. The text "Chlorite and Chlorine Dioxide" is written in a black serif font in the center of the page.

Chlorite and Chlorine Dioxide

Stage 1 Requirements

- Maximum contaminant level
 - Chlorite 1.0 mg/L
- Maximum residual disinfectant level
 - Chlorine dioxide 0.8 mg/L

Compliance Calculations

- Chlorite
 - Daily monitoring at plant tap
 - If exceed MCL at plant tap
 - Within 24 hours do a 3 sample set from distribution system (near plant, average and maximum)
 - Monthly monitoring in the distribution system at the same 3 sample set as above
 - Plant tap trigger can be used for this compliance monitoring
 - Compliance calculated by averaging the 3 sites

Compliance Calculations (continued)

- Chlorine dioxide
 - Daily monitoring at plant tap
 - If exceed MRDL at plant tap
 - Within 24 hours do a 3 sample set from distribution system with sites dependent upon whether you booster chlorinate or not
 - Exceedance of MRDL for compliance purposes
 - Acute: Tap exceeds and one of the 3 follow-up exceeds
 - Non-acute: 2 consecutive taps exceed but follow-ups are negative

Analytical Methods

- Chlorite
 - Daily plant tap testing
 - Amperometric titration
 - Can be done by a “party approved by EPA or the state” meaning a certified operator or lab technician, etc
 - Monthly distribution chlorite testing
 - Must be done by a certified lab
 - Must use ion chromatography

Analytical Methods (continued)

- Chlorine dioxide
 - Amperometric titration or
 - DPD titration
 - Can be done by a “party approved by EPA or the state” meaning a certified operator or lab technician, etc



Chlorine and Chloramines

Stage 1 Requirements

- Chlorine or chloramine residuals must be monitored at the same time and same sample points as compliance total coliform samples
- MRDL
 - Chlorine 4.0 mg/L
 - Chloramines 4.0 mg/L
- This monitoring **does not** replace the distribution monitoring that is recorded on the MOR

Compliance Calculations

- Monthly running annual average
- Compliance
 - 1st average the chlorine/chloramine results for the month
 - Add that average to the averages from the last 11 months
 - Divide by 12

Compliance Calculations (continued)

- **EXAMPLE** These are the monthly averages
 - April '03 2.4 mg/L
 - May '03 2.1 mg/L
 - June '03 1.9 mg/L
 - July '03 1.6 mg/L
 - Aug '03 1.5 mg/L
 - Sept '03 2.0 mg/L
 - Oct '03 2.0 mg/L
 - Nov '03 3.5 mg/L
 - Dec '03 2.2 mg/L
 - Jan '04 2.1 mg/L
 - Feb '04 2.3 mg/L
 - Mar '04 2.3 mg/L
- Total is 25.9
Divide by 12 =
2.16 mg/L monthly running
average

Analytical Methods (continued)

- Chlorine and Chloramines
 - Can be done by a “party approved by EPA or the state”
 - Most methods are colorimetric
 - Color wheels not recommended due to human variability in reading the color, fading of color wheels and not enough accuracy
 - Other methods include DPD titration and electrodes



Bacteriological Form Disinfectant Residuals



TOC

Stage 1 Requirements

- Treatment Technique for DBP precursor removal
 - If remove organics less to react with disinfectant and therefore less THMs and HAAs formed
- Monthly monitoring at the water plant of the raw water and a point no later than the combined filter effluent

Compliance Calculations

- Convoluted compliance
 - Sample raw water for TOC and alkalinity and CFE for TOC
 - Compare actual percent TOC removal to a required removal
 - This results in a removal “ratio” that must meet or exceed 1.00
 - Compliance calculated using a monthly running annual average calculated quarterly, based on these “ratios”
 - Multiple means of achieving the ratio

Compliance Calculations (continued)

- Step 1 Compliance
 - Do TOC and alkalinity each month
 - EXAMPLE: At the end of 1st Q of 2004
 - Add ratios from the 12 months from the beginning of 2nd quarter 2003 through 1st Q 2004
 - Divide by 12
 - Again, ratio must meet or exceed 1.00
 - Issues
 - If don't sample in the month the ratio is 0.00
 - Have seen TOC in CFE higher than in the raw; this is a negative removal (you are making TOC)

Compliance Calculations (continued)

- Alternative compliance ratios (“outs”) for conventional water treatment
 - Automatic compliance ratio of 1.00
 - Can be used on a month-to-month basis to assign an “automatic” 1.00 ratio
 - Raw TOC less than 2.0 mg/L
 - CFE TOC less than 2.0 mg/L
 - Raw SUVA less than or equal to 2.0 L/Mg-m
 - CFE TOC SUVA less than or equal to 2.0 L/Mg-m

Compliance Calculations (continued)

- Additional alternative compliance ratios (“outs”) for softening systems
 - Automatic compliance ratio of 1.00
 - If plant removes 10 mg/L magnesium hardness
 - If plant lowers alkalinity below 60 mg/L as CaCO_3
- **Still** must do the monthly TOC monitoring regardless of which “out” you use

Compliance Calculations (continued)

- Step 2 Jar Testing
 - If a system still can't meet compliance with the Step 1 compliance, including using the “outs”, move to Step 2 jar testing
 - A process of doing TOC removal jar testing, using certain procedure and coagulants to obtain an alternative required percent TOC removal
 - Can be confusing
 - Contact Technical Assistance & Outreach section of DWB for HELP!

Analytical Methods

- TOC
 - Can be done by a “party approved by EPA or the state”
 - Labs and utilities are encouraged to become certified (more credible)
 - 3 approved test procedures in Standard Methods
 - Issues
 - Drinking water samples run on same analyzer as wastewater or other liquids high in organics
 - Detection limit
 - Reproducibility

Analytical Methods (continued)

- Alkalinity
 - For use with TOC calculation or softening “out”
 - Can be done by a “party approved by EPA or the state”
 - Method specified is titration
 - Colorimetric endpoint
 - pH endpoint
 - **Cannot** use colorimetric method on a spec

Analytical Methods (continued)

- SUVA
 - This is a calculation of UV254 divided by DOC then multiplied by 100
 - UV254
 - Standard Methods test procedure
 - Cannot exceed 48 hour holding time
 - Can be done by a “party approved by EPA or the state”
 - DOC
 - DOC is the filtered version of TOC using specific filtration procedure
 - Refer to TOC analytical methods
 - Often SUVA will give you an “out” where TOC won’t



TOC Tracking Form

	Total Organic Carbon Compliance Worksheet						
YEAR: _____							
	A	B	C	D	E	F	G
MONTH	Source TOC (m/L)	Treated TOC (mg/L)	Actual TOC Removed (mg/L)	Actual TOC Removed (%)	Source Alkalinity (mg/L as CaCO ₃)	Required TOC Removal (%)	D/F*
January	3.5	2.8	0.7	20.0	80	25	0.80
February	2.0	1.8					1.0
March	2.9	1.3	1.6	55.0	100	25	1.0
April	6.0	3.2	2.8	46.7	110	35	1.33
May	2.2	2.0					1.00
June	2.1	2.3	-0.2	-9.5	50	35	-0.27
July							
August							
September							
October							
November							
December							
Total of D/F							
Monthly Average of D/F							

*D/F=Actual TOC Removed (%) divided by Required TOC Removal (%)



TOC Compliance Form



QUESTIONS?? COMMENTS??

Contact your Compliance Officer

At

502/564-3410